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# Fusarium Yellows of Cabbage and Related Crops

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Yellows or fusarium wilt of cabbage has been known in New York since 1899 when it was found first in the Hudson Valley. It now occurs in all states where cabbage is grown in warm seasons. Yellows is no problem in the southern states in winter-grown cabbage. Since 1909 many varieties with high resistance to the fungus have been developed and utilized. However, in recent years several European varieties with excellent horticultural characteristics, but no yellows resistance, have become popular in western New York. In warm seasons these varieties develop considerable yellows; thus growers should now switch to resistant varieties. Yellows can attack all members of the cabbage family, including cabbage, cauliflower, broccoli, Brussels sprouts, kale, kohlrabi, collards, and radish.

## Disease Symptoms

Plants will develop characteristic symptoms 2 to 4 weeks after transplanting, although the disease can appear in the plant bed where it is difficult to detect. The first sign of yellows is a lifeless, yellowish green color overall, but often more noticeable on one side of the plant. A lateral warping or curling of the stem and leaves occurs. The lower part of the leaf blade adjoining the petiole or midrib wilts and dies first, resulting in a curve in the midrib. The lower leaves turn yellow first, and then symptoms move to the upper leaves. With time, the yellow turns brown, and the tissue becomes dry and brittle. The vascular water vessels in the stems and leaves turn dark brown, resembling symptoms of black rot. However, in black rot the dying begins in yellow spots at the leaf margins and works downward, in contrast to yellows, which begins internally and appears in the lower portions of the plant first. Also in black rot the leaf veins become black, rather than brown, and are more apt to be discolored than in yellows. The speed of progress of yellows in the plant depends upon the degree of variety susceptibility and the soil temperature. Plants of some varieties growing in 75°–85° F soils may die within 2 weeks. Others may continue to decline throughout the season, die slowly, or even produce a poor head. If soil temperatures decline after infection, the plant may merely lose a few yellow leaves, recover, and make a normal head.

## Causal Fungus

*Fusarium oxysporum conglutinans* is closely related to the species causing wilts of tomato, cotton, garden pea, watermelon, and China aster. This fungus produces threads, which grow in the soil and on plant debris. It also has 2 types of spores, one of which is short-lived, and the other, heavy-walled and capable of withstanding long periods of low temperatures and drought. *Fusarium* can remain alive in the soil for many years and even increase in soil free of cabbage-family plants. The yellows fungus does

**Figure 1.** Fusarium yellows of cabbage

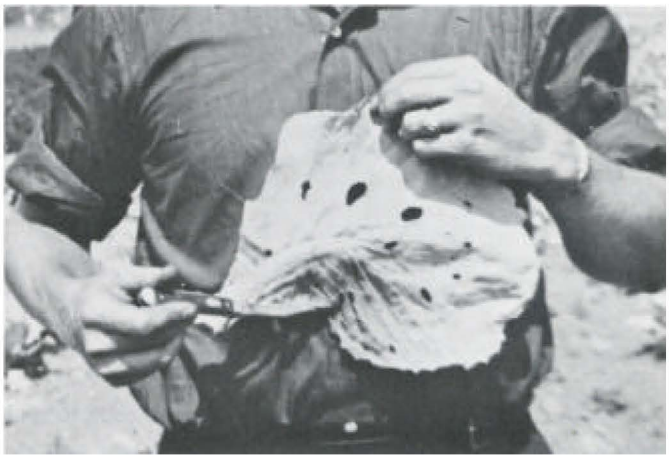

**Figure 2.** Yellows of cabbage showing curve in midrib

poorly at temperatures below 61° F and reaches its maximum growth rate between 80°–90° F. At 95° F it is greatly inhibited. Soil moisture and pH have little reaction on the fungus.

## Infection and Distribution

The fungus enters the plant mainly through the young rootlets, although wounds made in older roots at transplanting time may offer entrance pathways also. *Fusarium* penetrates the young roots, migrates directly to the water vessels, and finally progresses up the stem into the leaves. The rate of development depends upon temperature. When tissues die, the fungus threads spread through them and produce spores on the surface or, rarely, within the water vessels. These spores find their way back into the soil to threaten future crops. Perhaps the principal method of distribution of the fungus from region to region or farm to farm is via infected seedlings or infested soil, clinging to transplants, tractor and farm equipment wheels, and blowing cabbage leaves, or carried in flood waters. Seed plays no role in its distribution.

## Control

Since the yellows fungus can live free in the soil for many years and has several other characteristics that differ from most other vegetable disease fungi, the conventional controls such as rotation, seed treatment, fungicide sprays, and destruction of crop refuse are of little value once the fungus has established itself on a farm or in a specific field. Then the use of resistant varieties is the only control. Scientists have demonstrated that 2 types of genetic resistance, *A* and *B*, can occur. *A* type is resistant at all temperatures, whereas *B* type exhibits resistance only up to 77° F, above which plants will become infected. Fortunately many varieties with excellent horticultural characteristics, a range of maturity dates, and a high degree of *A*-type genetic resistance are now available. Table 1 lists a wide selection available from well-known seed merchants. These should be used for the major crop season with harvest July 15–November 15. Very early cabbage generally avoids the disease because of cool soil temperatures.

Table 1. Fusarium yellows resistant cabbage

| | |
|---|---|
| Badger Ballhead (YR) | King Cole |
| Badger Market | Little Rock |
| Defender | Marion Market (YR) |
| Early Harvest | Market Prize |
| Early Jersey Wakefield (YR) | Market Topper |
| | Market Victor |
| Empire Danish | Pak-Rite |
| Enterprise | Pennvalley |
| Excel (Tol) | Princess |
| Express | Quaker State Ballhead |
| Globe (YR) | Red Danish Ballhead (YR) |
| Globelle | |
| Glory 61 | Round Up |
| Golden Acre (YR) | Saf-Gard |
| Great Dane | Sanibel |
| Greenback (YR) | Special Golden Acre (YR) |
| Green Boy | |
| Green Express | Stonehead |
| Guardian | Sun Up |
| Harris Resistant Danish | Superette |
| Harvester Queen | Tastie·Hybrid |
| Hybrid 15 | Wisconsin Ballhead |

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